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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/829,212	04/22/2004	Takashi Iwamoto	403049	5541

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EXAMINER	
CHAPMAN JR, JOHN E	

ART UNIT	PAPER NUMBER
2856	

DATE MAILED: 04/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/829,212	IWAMOTO ET AL.	
	Examiner	Art Unit	
	John E. Chapman	2856	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2006*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *2/28/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claim 7 is objected to because of the following informalities: There is no proper antecedent basis for "the time-frequency transforming" in line 11. A step of time-frequency transforming should be recited. It is suggested that --and time frequency transforming the sampled ion currents-- be inserted after "intervals" in line 7. Appropriate correction is required.

3. Claims 1-12 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

It is not clear how to provide a "time-frequency transforming means for setting time intervals allowing at least one overlap of respective intervals within a time from after ignition by one of the spark plugs until the spark plug in the respective cylinder or in another cylinder next ignites, and sampling the ion currents in the respective time intervals to determine frequency components of the ion currents." According to the amended specification on page 9, lines 6-10, "the time-frequency transforming means 3 determines the frequency components $C_n(f)$ in respective time intervals from the sampled ion current included in the time intervals represented by the set In = (Tn, Tn+ΔT, ..., Tn+(M-1)ΔT)." However, it is not clear what "In" is, what "Tn" is, and what "time intervals" are represented by In. In Fig. 3, six time intervals, Interval 0 –

Interval 5, are illustrated. It would appear that Interval 0 corresponds to the set "I_0" and that "T_0" is the instant of the first measurement in Interval 0, that "ΔT" is the time interval between measurements, and that "M" is the number of measurements during Interval 0. If such is the case, then such should be clearly indicated in the specification. If not, then the correct interpretation should be indicated in the specification. Likewise, it is not clear what "time intervals" are recursively defined by the equation $T_{n+l} = T_n + (M/K)\Delta T$ on page 9, line 22. Applicant fails to identify "T_{n+l}." If "T_{n+l}" is the first element in the set I_{n+l} defined by $I_{n+l} = (T_{n+l}, T_{n+l}+\Delta T, \ldots T_{n+l}+(M-1)\Delta T)$, i.e., the instant of the first measurement in the time interval I_{n+l}, then such should be made clear in the specification.

4. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Frankowski et al. (6,456,927) in view of Malaczynski et al. (6,805,099).

Frankowski et al. disclose a knocking detection apparatus comprising a knock spectra responsive sensor 101, a time-frequency transforming means 109 (column 6, line 20) for setting time intervals (205 and 215 in Fig. 2) having overlapping data sets (column 11, lines 41-47), a knock detecting means (column 4, lines 44-47), and a means for inputting a running status (engine angular displacement). Frankowski et al. teaches that the knock spectra responsive sensor may comprise a flame ionization sensor (column 4, line 57). Frankowski et al. does not teach the specifics of the flame ionization sensor, in particular, Frankowski et al. does not teach detecting ion currents flowing in the spark plugs disposed in cylinders of an internal combustion engine. Malaczynski et al. teaches that it is known in the art to detect flame ionization using a spark plug (column 1, lines 28-30). Merely to use a spark plug in the apparatus of Frankowski et

al. for the purpose of sensing flame ionization would have been obvious to one of ordinary skill in the art.

Regarding claims 2 and 8, Frankowski et al. uses a fast Fourier transform (column 6, lines 18-19).

Regarding claims 3 and 9, the only further difference between the claimed invention and the prior art consists using a wavelet transform in the apparatus of Frankowski et al. Malaczynski et al. uses a wavelet transform (column 6, lines 46-52) in order to recognize critical features in the data sample (column 6, lines 18-20). It would have been obvious to use a wavelet transform in the apparatus of Frankowski et al. in order to recognize critical features in the data samples 205, 215 of Frankowski et al.

Regarding claims 4 and 10, Frankowski et al. detects the occurrence of knocking within a window 1-N in Fig. 2.

Regarding claims 5 and 11, the number of samples in a data set is dependent upon engine speed (column 5, lines 23-25).

Regarding claims 6 and 12, the only further difference between the claimed invention and the prior art consists in dividing a knock determination equation by a "standardizing factor." Frankowski et al. disclose a knock determination equation comprising the sum of Bessel function coefficients and compare the sum with a scaled, time-weighted version 909 in Fig. 9. It would have been an obvious mathematical equivalent to divide the sum of Bessel function coefficients by a time-weighted version and compare the ratio with a predetermined threshold (i.e., the scale factor). A time-weighted version 909 comprises a "standarding factor" in that it is used for

standardization. Alternatively, a non-knock variable (column 10, line 43) comprises a "standardizing factor."

5. Applicant's arguments filed February 28, 2006 have been fully considered but they are not persuasive. Applicant asserts that "In" means a discrete time and that the interval means a set consisting of the times (Tn, Tn+ΔT, ..., Tn+(M-1)ΔT). However, Interval 0 in Fig. 3 is not a "discrete time" but rather is a time interval. Furthermore, the set (Tn, Tn+ΔT, ..., Tn+(M-1)ΔT) would appear to be the set of times in the time interval "In" at which measurements are taken. While T_{n+1} may be defined by the recursive formula $T_{n+1} = T_n + (M/K)\Delta T$, T_{n+1} has significance beyond the recursive formula, namely, it appears to be the time of the first measurement in the time interval I_{n+1}. If such is the case, then such should be made clear in the specification.

Applicant argues that although Frankowski et al. refers to a flame ionization sensor, the preferred sensor is an accelerometer for measuring mechanical vibrations. While the preferred sensor in Frankowski et al. may be an accelerometer, Frankowski et al. clearly teaches other sensors, such as a flame ionization sensor, may be substituted for the accelerometer.

Applicant argues that the reference to a flame sensor is not a reference to a measurement of ion current or an ion current sensor as in the present invention. Applicant argues that a flame ionization sensor measures ionization attributable to flames within a cylinder of an internal combustion engine, whereas in applicant's invention ion currents are sensed directly through the spark plugs of the internal combustion engine. However, it is known in the art to use a spark plug as a flame ionization sensor, as evidenced by Malaczynski et al. It is not evident that the ion current produced in the spark plug by flame ionization is in any manner different from the

ion current produced in the spark plug claimed by the applicant. Note the ion current signal U_{ion} in Fig. 2 of Nytomt et al. in this regard.

Applicant argues that if Frankowski's flame ionization signal processing apparatus were directly connected to spark plugs, as in the invention, Frankowski's circuitry, particularly the analog-to-digital converter, would the destroyed because of the strength of the ignition signal. However, it is well known in the art to filter out the high measuring pulse caused by spark discharge. Note column 5, lines 60-65, of Nytomt et al. Accordingly, applicant fails to distinguish the claimed invention over that of Frankowski et al. wherein a spark plug is used to detect flame ionization.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John E. Chapman whose telephone number is (571) 272-2191. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron Williams can be reached on (571) 272-2208. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JOHN E. CHAPMAN
PRIMARY EXAMINER